From Physics to Finance:
What Does a Quant Say?

David K. Clark
Quantitative Research Analyst
Tradelink Holding, LLC

email: dkclark@brandeis.edu

Life After Graduate School, University of Michigan,
Ann Arbor, November 15, 2013

Outline

- Quantitative analysis in finance requires many of the skills of today's physics and math graduate students.
- The market environment is ever changing via new technologies, instruments, and regulations.
- How have quantitative strategies weathered the upheaval in the finance industry over the past six years?
- Is the culture in finance different or similar to academia?
- How does one successfully transition to finance?
- A career choice that physicists and mathematicians have been gravitating towards for decades.

The mathematical links between Physics and Finance

- 1900: Louis Bachelier's *Theory of Speculation* - used a random walk to analyse fluctuations on the Paris stock exchange.
- 1905: Einstein uses Brownian motion to describe pollen suspended in water.
- 1967: Ed Thorp, *Beat the Market: A Scientific Stock Market System*
- 1973: Fischer Black & Myron Scholes: The pricing of options
- 1990: Black–Derman–Toy model of short term interest rates

Environment: 2007-Now

- Aug ‘07: Meltdown begins with a major bank blocking withdrawals from 3 Hedge Funds
- GFC of 2008
- New regulations: Dodd-Frank Reform Bill
- Quantitative Easing
- US stock markets at all time highs again
- Capital gains tax increase
- Economic recovery weak but steady
- 2013: Hedge fund industry recovering to levels pre-GFC

Who, What and Where

- Who needs PhDs:
  - hedge funds, "quant shops"
  - investment banks
  - proprietary trading firms, "prop shops"
  - research firms
- Quantitative finance positions:
  - quant researcher, developer, back-office/risk quant, front-office/desk quant
  - trader, fund manager
- New York, Chicago, London, Hong Kong

Why physicists?

- Analytical, inquisitive, problem solver, work independently, etc., etc.,...
- Skill set match - **Bingo!**
  - math
  - programming
  - handling large data sets
  - modeling
- Other fields of science and math require these skills - not just physicists hired

What's it like?

- Culture varies greatly - specific to firm/group
- Hours: typically market hours, "9-5"
- Support structure: team of developers, sys admins, help desk personnel
- Significant thought on research direction
- Timelines much shorter than academia
- Most projects are proprietary, the firm's IP
- Connection to Academia, finance journals
- A typical day in the life of a quant

What does it take to transition?

- Knowledge of industry helps
  - Be familiar with historic and current events
    - 1987 Stock Market crash
    - LTCM collapse in 1998
    - May 2010 Flash Crash
  - Understand derivatives (options, futures)
  - You are not expected to be a finance expert but must show interest
- Read, read, read
- Network, network, network
- Contact a quant recruiter
- Know thyself - where you might fit in?

Skills required

- Coding: C/C++,C#, Java, Python, VB
  - strength in C/C++ is often necessary
  - will likely have to learn another on-the-job
- Stats/modeling language/software packages
  - Numpy/SciPy (python)
  - R
  - SAS, *Statistical Analysis System*
  - Matlab
- Database query language, eg., SQL
- Math: probability, statistics, time series analysis, signal response analysis, PCA

Skills continued...

- More math and modeling: stochastic calculus, Monte Carlo, linear regression
- Understand pricing and risk models and their limitations
  - Black-Scholes option model
  - Value at Risk (VaR)
- Soft skills:
  - ability to communicate complex ideas !!!
  - work independently, but also work well with others

Preparing for an interview

- Refresh your maths - you will be tested
- Clear and concise description of your research - you will be asked
- Developer
  - know the standard libraries and structures in C++
  - know your algorithms: sorting, random, shortest path
- Did you use Root, Matlab in your research? look under the hood
  - what kind of regression and why?
- You may be given a homework project

Achieving success

- Communicate complex ideas well
- Know the limitations of maths, models, algos
- Balance thoroughness with timeliness
- Don't overfit the data!
- Bring new ideas, new sources of *alpha*
  - quantify human behaviors
  - Twitter feeds ?
  - AP, Thomson-Reuters news feeds
- Build market intuitions
- Start your own group within firm

Resources

- Books
  - *The Quants*, Scott Patterson (WSJ)
  - *My Life as a Quant: Reflections on Physics and Finance*, Emanuel Derman
  - *Options, Futures and Other Derivatives*, John C. Hull
- Websites
  - quantfinancejobs.com
  - topcoder.com: algorithm tutorials
  - wilmott, quantnet: Quantitative finance community
  - "Learning from Data", Yaser Abu-Mostafa, Caltech Machine Learning class lectures, on youtube
  - ftalphaville.ft.com - finance news, blog, commentary